CASE REPORT

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Possible effect of high origin and retrocaval course of testicular artery on the target organ: A case report and functional implication hypothesis

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ABSTRACT

Testicular arteries are the main blood supplier for testes. Knowing the anatomy, relation and especially variations of them is critical for surgical procedures such as varicocelectomy and kidney transplantation. Most of the case reports of anatomical variations focus on morphological features, embryological background and in some cases following clinical problems but the effect of anatomical

variations on the physiological characteristics of the target organ have been ignored. What we are trying to emphasize is that introducing a relation between the testicular artery variations and function of the testis as a target organ.

Keywords: Anatomical variation, Testicular artery, Target organ, vascular resistance.

1. INTRODUCTION

The testicular arteries are long, paired and slender arteries, which arise from the anterior surface of the aorta, slightly inferior to the renal arteries (Gray and Standring, 2008). However, arteries may originate 2.5 to 5 cm below renal arteries and also arise from different arteries such as lumbar aa., suprarenal a., superior epigastric a. (Lelli et al., 2007). Both arteries lie in retroperitoneal while in the anterior right artery crossing over inferior vena cava (IVC) and the left testicular artery lies posterior to two vessels (inferior mesenteric vein, left colic artery). Genitofemoral and the external iliac arteries and ureter lie in the posterior of the testicular arteries in both sides. Testicular arteries pass inferolateral and enter the deep inguinal ring to reach to the testes as a target organs (Gray and Standring, 2008). According to Notkovitch classification, the gonadal arteries may have three types of origin in comparison with renal vein:

Type I: the artery arises from the aorta and descends directly.

Type II: origin in the higher position than the renal vein.

Type III: The artery arches around the renal vein and then descends (Lelli et al., 2007).

As in previous studies, vascular variations were focused on anatomical (Cicekcibasi et al., 2002), embryological (Terayama et al., 2008) and clinical interests (Bandopadhyay and Saha, 2009) whereas the effects of structural differences on function were completely neglected. In this paper, we are trying to emphasize on the possible correlation between functional changes in the target organ and the vascular variation.

2. CASE REPORT

Variation was found during dissection in an 82 years Old Iranian male cadaver. The abdominal cavity was dissected and then retroperitoneal cavity testicular arteries were observed. The RT testicular artery takes origin from the anterior side of the aorta, between renal and suprarenal artery and approximately 2.5 cm above renal artery and higher to renal vein. As in previous studies, founded variation can be placed in Notkovitch Type II varieties (Lelli et al., 2007). Then the artery passes behind IVC which Previous studies called retrocaval position and found in 20% of cadavers (Mao and Li, 2017). After crossing behind IVC horizontally and descends with accompanying vein in inferior direction. No anomalies were found in the left gonadal vessels (Fig 1 & 2).

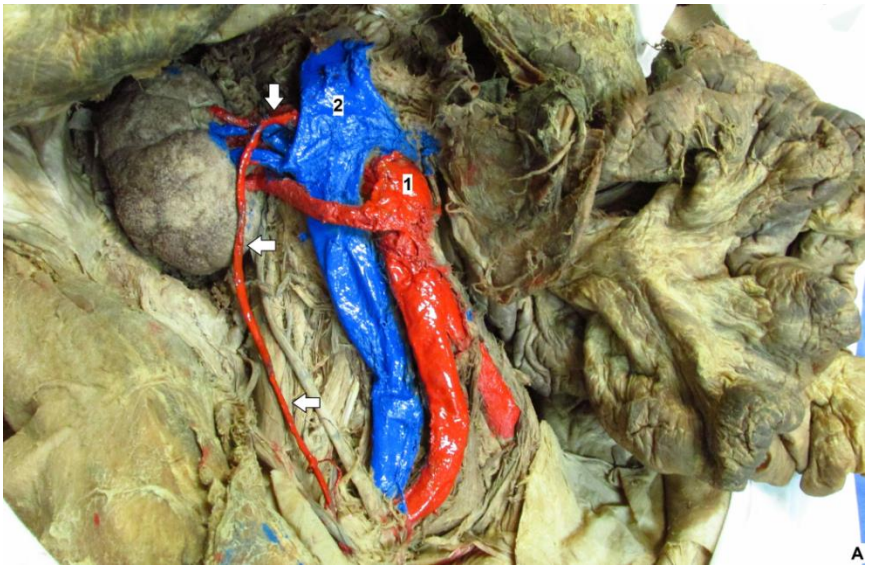

Figure 1 The image shows retroperitoneal space. Aorta & IVC were marked by 1(red) and 2 (blue) respectively. RT testicular artery was signed by arrow (head down) in origin and their course (head lefts arrows).

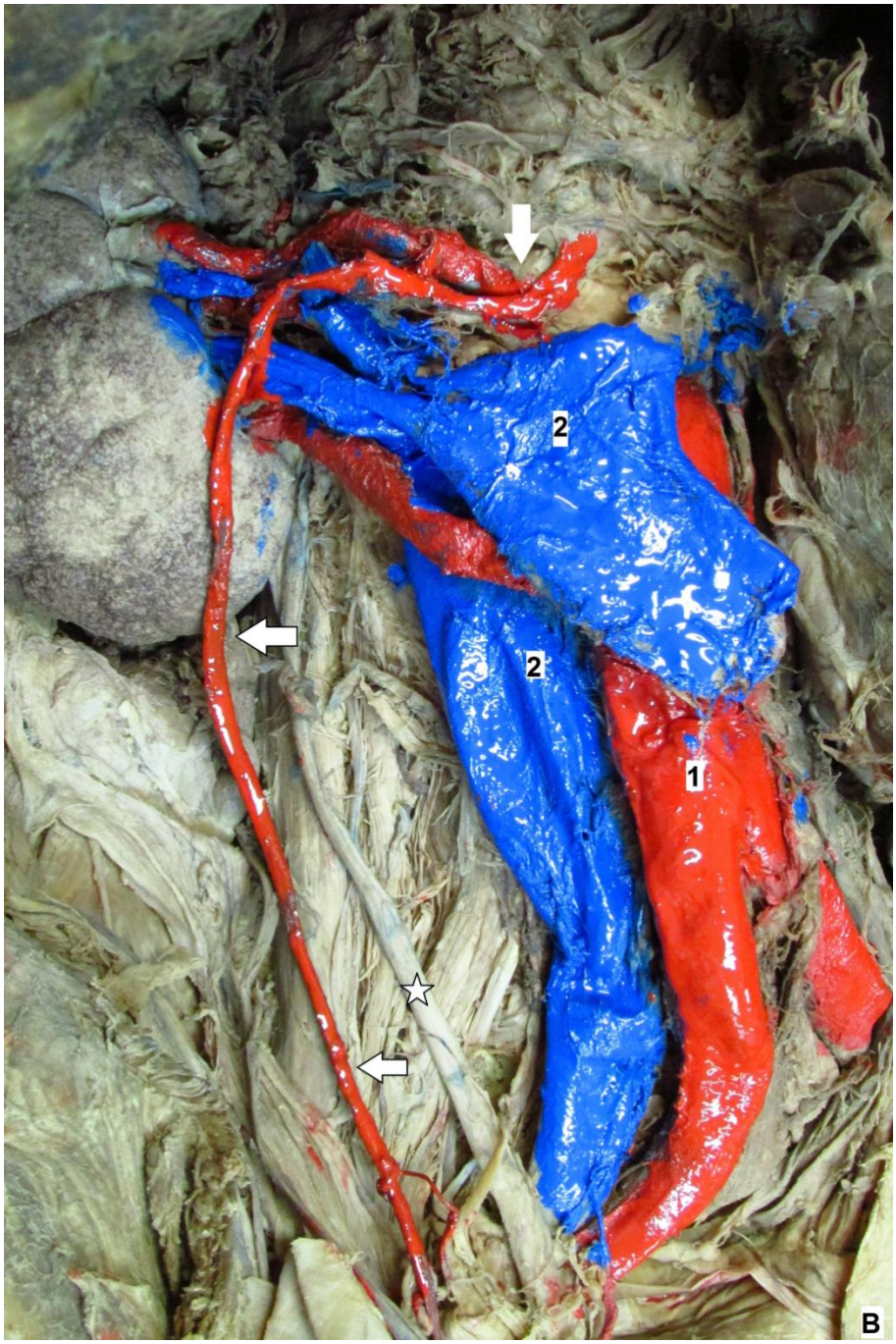

Figure 2 IVC (Lelli et al., 2007) retracted for better visibility of RT testicular artery origin. Arrows indicate right testicular artery direction and origin. Star indicates RT testicular vein.

3. DISCUSSION

Testicular artery variations describe by site of origin, existence of accessory, and the Course of artery. Mainly, testicular artery arises from abdominal aorta, renal trunk, and accessory or segmental renal arteries. Accessory artery doesn't have a unique anatomic sign therefore; it is arbitrary to commit which branch as a main and which one as an accessory. In the case of course of artery, position of artery in relation to the renal vein is known as the criteria. There are 4 well known classification study for testicular artery variations; Çiçekcibasi, Radojevic and Stolic, Machnicki and Grzybiak systems classified variants based on origin and number of artery whereas Notkovitch, the 4th classification grades variations according to the origin and the course of artery as well. Our finding classify in Notkovitch Type II subclass. More details about Notkovitch subclass are presented in introduction section (Kayalvizhi et al., 2017).

Embryological background explains the reason of alteration in course and origin place of testicular artery. Remaining cranial part of mesonephric artery is the cause of the existence of a high origin gonadal artery. The term of 'retrocaval' is used to describe the anatomic relationship of the testicular artery. Lateral splanchnic artery in fetus persists as right testicular artery in adult. If right testicular artery passes cranially to the subcardinal anastomosis (one of three pair of venous channel which make up IVC by regression, anastomosis and replacement), right testicular artery is located behind IVC (Mirapeix et al., 1996).

The testis has three different blood suppliers include testicular, cremasteric and vas deferens arteries which with receiving to the testis all of them make anastomose for adequate blood flow. Although testicular arteries are the main blood supplier (Mostafa et al., 2008). Testicular artery blood flow (TABF) decrease in consequence of other pathological condition like varicocele (Tarhan et al., 2003). Decreasing changes in TABF have an important effect on increase infertility rate in male(Matsuda et al., 1993). Effective factors have the influence on TABF are end-diastolic velocity (EDV), peak systolic velocity (PSV) and resistive index(RI) (Biagiotti et al., 2002). RI is a resistance which impediment against blood flow and can alter by many factors (Keats, 2002). In the other hand, resistance has the inverse effect on arterial conductance. Vascular Resistance can be quantified by Hagen– Poiseuille's Law which equal to:

$R=8\mu lQ/\pi r^4$

Where the R is resistance, μ is viscosity, L stand for the length of artery and r states to the radial of the artery (Ganong, 2016). It should be considered that change in artery length effect on vascular resistance (Hall, 2015). In our case, the higher origin of RT testicular artery and also its retrocaval direction make the artery longer than normal. Another positive contribution in vascular resistance increment is the shift in artery direction. Normally, testicular arteries have the straight direction to inferior while Retrocaval course changes the direction of artery dramatically. However, change in direction is not mentioned in Poiseuille's Law formula but basically, Poiseuille's Law defines for a direct tube.

Moreover, change in origin place might prepare the artery for atherosclerosis. In this case right testicular artery origin located between renal arteries origins. renal artery bifurcation area is one of the susceptible sites for atherosclerosis plaque developing (Vander Laan et al., 2004). Atherosclerosis plays a key role in vascular resistance due to modification in vessel diameter.

Doppler sonography is the useful diagnostic procedure for assessment of blood flow and resistive index in pathological and infertility cases (Krebs et al., 2015 and Mohammed et al., 2016). Due to the complexity of the testis structure and small diameter of artery Doppler sonography performs in the spermatic cord at the entrance point of the artery to the testis (Tarhan et al., 2003). Therefore, the etiology of blood flow alteration could be missed.

4. CONCLUSION

Testicular artery variations have the embryological background which important in surgical procedures. Blood flow change due to vascular variation can effect on testes as the target organ. CT angiography can be utilized for better functional assessment.

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Conflicts of Interest: The authors declare no conflict of interest.

Ethical approval

Ethic rules during cadaver dissection and preparation were considered.

REFERENCE

1. Bandopadhyay M, Saha A. Three rare variations in the course of the gonadal artery. Int J Morphol 2009; 27:655-8.
2. Biagiotti G, Cavallini G, Modenini F, Vitali G, Gianaroli L. Spermatogenesis and spectral echo-colour Doppler traces from the main testicular artery. BJU international 2002; 90:903-8.
3. Cicekcibasi AE, Salbacak A, Seker M, Ziylan T. The origin of gonadal arteries in human fetuses: anatomical variations. Anatomischer Anzeiger 2002; 184:275-9.
4. Ganong W. Ganong's Review of Medical Physiology. (KE Barret, SM Barman. S. Boitano. & HL Brooks. Eds.) USA. Mcgraw-Hill LANGE Basic Science 2016.
5. Gray H, Standring S. Gray's anatomy: the anatomical basis of clinical practice: Churchill Livingstone 2008.
6. Hall JE. Guyton and Hall textbook of medical physiology e-Book: Elsevier Health Sciences 2015.
7. Kayalvizhi I, Narayan RK, Kumar P. Anatomical variations of testicular artery: a review. Folia morphologica. 2017; 76:541-50.
8. Keats TE. Atlas de medidas radiológicas: Elsevier España 2002.
9. Krebs J, Göcking K, Pannek J. Testicular resistive index

determined by Doppler ultrasonography in men with spinal cord injury–a case series. Andrologia 2015; 47:811-5.
10. Lelli F, Maurelli V, Maranillo E, Valderrama-Canales F. Arched and retrocaval testicular arteries: a case report. European Journal of Anatomy 2007; 11:119-22.
11. Mao Q-h, Li J. Double Right Testicular Arteries Passing Through the Hiatus in the Trifurcated Testicular Vein. Indian Journal of Surgery 2017; 79:73-4.
12. Matsuda T, Horii Y, Yoshida O. Should the testicular artery be preserved at varicocelectomy? The Journal of urology 1993; 149:1357-60.
13. Mirapeix R, Sañudo J, Ferreira B, Domenech-Mateu J. A retrocaval right testicular artery passing through a hiatus in a bifid right renal vein. Journal of anatomy 1996; 189:689-90.
14. Mohammed W, Davis N, O'Connor K, Kiely E. Re-evaluating the role of Doppler ultrasonography in patients presenting with scrotal pain. Irish Journal of Medical Science 2016; 185:705-9.
15. Mostafa T, Labib I, El-Khayat Y, El-Shahat AE-R, Gadallah A. Human testicular arterial supply: gross anatomy, corrosion cast, and radiologic study. Fertility and sterility 2008; 90:2226-30.
16. Tarhan S, Gümüs B, Gündüz İ, Ayyildiz V, Göktan C. Effect of varicocele on testicular artery blood flow in men color doppler investigation. Scandinavian journal of urology and nephrology 2003; 37:38-42.
17. Terayama H, Yi S-Q, Naito M, Qu N, Hirai S, Kitaoka M, et al. Right gonadal arteries passing dorsally to the inferior vena cava: embryological hypotheses. Surgical and Radiologic Anatomy. 2008; 30:657-61.
18. VanderLaan PA, Reardon CA, Getz GS. Site specificity of atherosclerosis: site-selective responses to atherosclerotic modulators. Arteriosclerosis, thrombosis, and vascular biology 2004; 24:12-22.